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WETLAND REHABILITATION AND CREATION IN THE PACIFIC NORTHWEST

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16. ABSTRACT

The rehabilitation/creation of wetlands in the Pacific Northwest is in its infancy. The oldest, best documented project is the Army Corps of Engineers; Miller Sands Marsh and Upland Habitat Development Project on the Columbia River, completed in 1977. Most permitted projects in the region are less than five years old. In Oregon and Washington the majority are located west of the Cascade Mountains and near urban centers. In Oregon, most have been small(< 10 acres), typically one acre or less.

Types of wetlands being rehabilitated/created are intertidal mudflats, seagrass beds, salt marshes, fresh water ponds and associated wetlands, and riparian and in-stream habitat. Most available information relates to the creation or improvement of habitat functions in fresh water ponds and associated wetlands, tidal fresh water and salt marshes, and riparian and in-stream areas.

The permitting/mitigation process, e.g. Section 404 of the Clean Water Act, has an impact on the rehabilitation/creation of wetlands. Difficulties involving a wetland scientist early in the planning process and completing the construction as planned hinder efforts to evaluate the ability of agencies to condition permits. When projects are monitored, it is primarily observational, not quantitative. To evaluate the success of a rehabilitation/creation project goals must be clearly stated, the construction plans given, the proper incorporation of design features verified, and a quantitative monitoring program established.

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Abstract

The rehabilitation/creation of wetlands in the Pacific Northwest is in its infancy. The oldest, best documented project is the Army Corps of Engineers' Miller Sands Marsh and Upland Habitat Development Project on the Columbia River, completed in 1977. Most permitted projects in the region are less than five years old. In Oregon and Washington, the majority are located west of the Cascade Mountains and near urban centers. In Oregon, most have been small (<10 acres), typically one acre or less.

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Introduction

Research and experience in the rehabilitation/creation of wetlands in the Pacific Northwest are limited. In this region it is a relatively new endeavor with most projects less than five years old; the median age is two or three years.

In a recent review of the creation and restoration of Pacific coastal marshes, Knutson and Woodhouse (1982) present guidelines "based on perhaps five field planting experiments, 20 years of first hand experience by the authors, and a great deal of conjecture." Of the 54 references cited, only one dealt with the rehabilitation/creation of coastal wetlands in the Pacific Northwest, i.e., the U.S. Army Corps of Engineers' Miller Sands Marsh and Upland Habitat Development Project (Clairain, et al. 1978). Miller Sands, on the Columbia River, is the oldest, best documented wetland creation project in the region.

Wetland rehabilitation/creation is commonly proposed as mitigation for wetland losses permitted under Section 404 of the Federal Clean Water Act and state removal-fill laws. Since the science of wetland rehabilitation/creation in the Pacific Northwest is in its infancy, there is a great need to continue documenting what is known, to identify information gaps, and to initiate research.

Documentation of Wetland Rehabilitation/Creation in the Pacific Northwest

The permit record--The occurrence of wetland rehabilitation/creation as mitigation for permitted wetland alteration was examined. The entire permit record of the Oregon Division of State Lands (1980 to the present) and a partial record for the State of Washington (FY83 to the present), provided by the U.S. Fish and Wildlife Service, were analyzed.

In Oregon and Washington most projects (>80%) are west of the Cascade Mountains near urban centers (Fig. 1). Analysis of Oregon records revealed additional patterns. About 50% of the projects are in fresh water systems and about 50% are in saline systems. Projects have been small (<10 acres), typically one acre or less. Of the permits granted between 1980 and 1985, 67% were issued in 1985 (Table 1). Consequently, two-thirds of the projects permitted in Oregon either were just recently completed or are in some stage of construction.

The scientific literature--The readily accessible literature on rehabilitation/creation of wetlands in the West, and especially the Pacific Northwest, is limited. A computer search of three databases to identify publications on the rehabilitation/creation of wetlands located 277 items; 22 applied to California, Idaho, Oregon or Washington (Table 2). Nine of these were publications from the Army Corps of Engineers' Dredged Materials Research Program.

Most of the information presented in this paper was obtained through interviews with people in the region. They shared their personal experience and their knowledge of printed resources not generally available.

Other sources of information--Many wetland rehabilitations/creations are not recorded in the permit record. For example, wetlands are created in the management of wildlife refuges, and the Soil Conservation Service oversees farm pond development across the nation.

Most of the wetland rehabilitation/creation in Oregon and Washington not recorded in the permit record has been of riparian and in-stream systems. Both states have programs to restore salmon and trout habitat. In Oregon's Salmon and Trout Enhancement Program, Department of Fish and Wildlife biologists supervise the work of volunteers to increase fish habitat. Concurrently, the program educates the public on the importance of riverine wetlands. The Bonneville Power Administration has an active program of stream enhancement. A Bureau of Land Management research program focuses on the prevention and restoration of stream damage caused by grazing. As part of their continuing research on the ecology of streams, the Forest Service's Intermountain Research Station recently initiated research to develop restoration techniques for riparian systems in arid regions.

Rehabilitation/Creation of Specific Wetland Types in the Pacific Northwest

Coastal

Salt marshes--Sedimentation, and the construction of dikes, landfills and jettys have significantly modified the salt marshes of the Pacific Northwest. Almost no areas of old, high marsh remain undiked in Oregon (Jefferson 1974); dike removal is commonly proposed to restore this habitat.

A diked wetland in the Salmon River Estuary (Lincoln County, Oregon) was breached in 1978 (Mitchell 1981). During the first year after breaching the upland, pasture-type plant species suffered almost 100% mortality. Wetland plant species invaded the area. However, since the land had subsided 0.3-0.4 m with diking, an intertidal to low transitional salt marsh developed. The high transitional marsh that probably existed before diking was not restored. The new marsh was compositionally and functionally different from the pre-dike marsh.

Knutsen and Woodhouse (1982) described techniques for growing the salt marsh plants Carex lyngbyei Hornem. (Lyngby's sedge), Deschampsia cespitosa (L.) Beauv. (tufted hairgrass) and Triglochin maritimum L. (seaside arrowgrass). Seeding has often been a failure. Transplanting sprigs is most common and successful. Plugs with soil and pot-grown seedlings, although awkward to transport and handle, are typically successful.

Seagrass beds--Attempts to create eelgrass (Zostera marina L.) beds in the Pacific Northwest have been limited. Phillips (1982) stated that the best results are obtained using plugs. He

reported 100, 100, 67 and 50% success for four plantings in Puget Sound. Plantings using seeds have had little or no success.

As a result of their experience in the southeastern United States, Thayer, Fonseca and Kenworthy (in press) stress the need to consider the site history. If a seagrass bed chronically has a low density of vegetation, attempts to increase density with transplants will result in a short-term pulse. The system will quickly return to its natural configuration. Planting a site that naturally lacks seagrass carries a high risk of failure.

Tidal fresh water--The Army Corps of Engineers' Dredged Materials Research Program attempted to establish fresh water marsh and area of upland vegetation on Miller Sands, a dredged spoil island in the Columbia River. The 2.5 year study was conducted from March 1975 to August 1978. Pre- and post-project inventories monitored changes in the chemical and physical conditions, vegetation, and animals. Zooplankton, invertebrates, fish, birds and mammals also were studied. Results pertaining to marsh creation (summarized by Clairain et al. 1978) are presented below.

Plant propagation was generally successful in the intertidal areas. Planted areas were fairly well established by August 1977 and the plants were beginning to invade bare areas. Deschampsia caespitosa and Carex obnupta Bailey (slough sedge) were successfully established from sprigs at elevations >67 cm above mean lower low water. Application of fertilizer had no significant effect on the establishment or production rates of Carex obnupta. Intertidal mixed plantings of transplants of

Carex lyngbyei, Scirpus validus Vahl (American bulrush), Juncus effusus L.(common rush), Iris pseudacorus L.(yellow flag) and Alisma plantago-aquatica L.(water plantain) were successful. Almost no plants were established by seeding any of the species.

Colonization of animals in the planted areas reflected the early stages of succession during which the animal populations were sampled. Plantings seemed to have no detectable influence on the aquatic biota. Fish distribution and abundance were the same before and after habitat development. The marsh developed by July 1977 had little influence on the benthic community. Bird use of the intertidal areas slowly increased as development of the marsh progressed. Avian species composition changed in the intertidal areas from those preferring bare, sandy areas to those preferring vegetated areas.

More recently, Brian Lightcap (Army Corps of Eng., Portland, pers. com.) documented the self-establishment of tidal fresh water marsh vegetation on dredged spoil in the Columbia River.

Intertidal mudflats--Intertidal mudflats are being created as mitigation projects in the Pacific Northwest, but little is known about their status. The development of an invertebrate community is desired. Sampling to characterize these communities is difficult and time consuming; no documentation was found for such projects in the Pacific Northwest.

Fresh water impounded

Literature on the creation/rehabilitation of fresh water wetlands in the Pacific Northwest is becoming more available. There is considerable expertise on the construction of fresh water ponds and associated wetlands to increase habitat functions. However, no information was found on bogs and fens.

Fresh water wetlands are typically constructed in urban areas. Virtually all such projects in Oregon are in the Portland Metropolitan area. The work of Milligan (1985), and Milligan and Raedeke (in press) describes how to integrate wetlands for wildlife habitat into urban development projects. Shallow ponds and associated wetlands with year round water are of particular value to waterfowl, since natural wetlands often dry up in the summer (G. Herb, OR Dept. of Fish and Wildl., pers. comm.). Nesting islands are a common feature of these pond systems. A combination of open water, and emergent and shrub-scrub wetlands is desired for maximum potential for wildlife use. Emergent vegetation for spring nesting habitat is particularly important. However, the ability to create such areas is often constrained by the small size of the typical urban project and the availability of adequate funding (D. Milligan, Raedeke Assoc. Sci. Consulting, pers. comm.). The challenge for the resource agencies is to maintain habitat in urban settings that supports wildlife for non-consumptive purposes, e.g., bird watching, photography, and educational use (Herb 1986).

Riverine

Restoration of riparian and in-stream habitat is occurring on both the east and west sides of the Cascade mountains. Activities supervised by the Oregon Department of Fish and Wildlife were reported in Oregon Wildlife. Claire's work on Murder's Creek and the South Fork of the John Day was described (Gladson 1983). Newton's (1981) work on Fifteenmile Creek, south of The Dalles, is summarized below.

The Fifteenmile Creek area, like many others in the Pacific Northwest, suffered deterioration due to grazing, agriculture, timber harvest and irrigation withdrawals. The area had been averaging two severe floods per 10-year period. A restoration/stabilization project, initiated in 1974, involved an 8-to 10-mile reach of the stream. Results are encouraging. Where the plantings were protected, recovery of streamside vegetation was noticeable within four years (Newton 1981). However, Meehan and Platts (1978) caution that although many western rangelands have improved through management and revegetation programs, many riparian habitats have responded slowly to treatments.

Monsen (1983) lists the conditions that influence restoration of riparian wetlands in the intermountain region:

1) Protection for the vegetation;
2) Accessability by mechanical equipment;
3) Variation in plant communities and site conditions;
4) Serious alteration of the site, e.g., erosion, lack of vegetation or topsoil, lowered groundwater;
5) Competition with weeds; and

6) Fluctuating water levels, i.e., high runoff and flooding in the spring, drought in the summer.

He also states that willow (Salix), dogwood (Cornus) and cottonwood (Populus) are easy to propagate from local cuttings.

In-stream restorations are primarily directed toward upgrading salmonid habitat. However, some improvements can serve the dual purpose of raising the water table in areas of former wet meadows (Bowers et al. 1979). The favored in-channel treatments are current deflectors, overpour structures (dams and wiers), bank covers (structures to create streamside covers) and boulder placements. Digger logs, trash catchers, simple gabions (rock filled wire structures), substrate manipulations, pool excavation, channel blocks/barriers and beaver management are less common (Wesche 1985).

Gabions currently are receiving attention because the Bonneville Power Administration plans to place a large number of them in the John Day system. Use of gabions has been criticized for esthetic reasons (U.S. Forest Ser. 1952). Their susceptibility to damage and need for frequent repair also has been cited as a problem. However, low-profile gabions have been described as effective, easy to install, fairly inexpensive and strong enough to withstand high discharge (Wesche 1985).

Summary and Conclusions

Most of the easily accessible literature on wetland rehabilitation/creation in the Pacific Northwest is specific to the habitat functions of fresh water ponds and associated wetlands, salt and tidal fresh water marshes, and riparian and

in-stream areas. Information that can be extracted from the permit record is uneven. For some projects site descriptions and detailed construction plans are provided, but usually few specifics are available. What detailed information that might exist must be "tracked down" by contacting the agencies that reviewed the permit request, and the biological consultant for the project, if one was contracted. Therefore, it is often difficult to gather enough information to evaluate both the design of the projects and the conditions imposed on the permits.

Even when detailed information on the plans and goals for rehabilitation/creation projects is readily available, evaluation of project design is often hindered because the construction was not done as planned. Many times a wetland scientist is not involved until late in the process. Monitoring of projects, when it is does occur, is primarily observational, not quantitative.

To effectively evaluate the success of rehabilitation/creation efforts, documentation is needed. The goals of the project should be clearly stated and the construction plans given. When the project is completed a representative of the agency in charge should visit the site to assure that the design features proposed were properly incorporated. This reconnaissance should include the project biologist, if one was employed. Finally, a monitoring program that produces quantitative information and provides for its analysis should be implemented.

However, the potential for evaluating existing projects by viewing them as "experiments in progress" should not be ignored.

Since there is much to learn about the process of rehabilitating/creating wetlands, a systematic appraisal of projects and follow-up reporting would greatly augment the existing body of knowledge.

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Table 1. The number of permits issued each year by the Division of State Lands that required mitigation under Oregon's Removal-Fill Permit Program.

1980	1
1981	0
1982	3
1983	7
1984	6
1985	35

Table 2. Literature on the rehabilitation/creation of wetlands in Oregon, Washington and California identified through a computer search of three literature databases[1]. * indicates publications of the Army Corps of Engineers' Dredged Materials Research Program. The key words used were wetland OR marsh OR riparian OR lacustrine OR palustrine OR riverine OR shallow vegetated area AND artificial OR create OR creation OR construct OR restor? OR enhance OR design OR reclaim? OR reclaim OR planting guideline? OR habitat develop? AND Washington NOT DC OR Oregon OR Pacific coast OR West coast OR Pacific Northwest; question mark (?) indicates all possible forms of the word. Bogs and fens were not used as key words in this search because an earlier effort indicated they added no new information.

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[1] The National Technical Information Service database consists of government-sponsored research, development, and engineering plus analyses prepared by federal agencies, their contractors or grantees. The COMPENDEX database provides coverage of the world's significant engineering and technological literature. CAB ABSTRACTS is a comprehensive file of agricultural biological information published in journals, reports, books and other publications.

LIST OF FIGURES

Figure 1. General location of mitigation projects in Oregon and Washington. Each dot represents one project. For Oregon the entire permit record of the Division of State Lands from 1980 to the present is represented. For Washington the record of the U.S. Fish and Wildlife Service for FY83 to the present is represented.